APPENDIX G:

ESSENTIAL FISH HABITAT ASSESSMENT FOR THE BANGOR HYDRO-ELECTRIC COMPANY NORTHEAST RELIABILITY INTERCONNECT

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G.1 INTRODUCTION

Executive Order (E.O.) 10485 (September 9, 1953), as amended by E.O. 12038 (February 3, 1978), requires that a Presidential permit be issued by the U.S. Department of Energy (DOE) before electric transmission facilities may be constructed, operated, maintained, or connected at the U.S. international border. Bangor Hydro-Electric Company (BHE) has applied to DOE to amend Presidential Permit PP-89, which authorized BHE to construct a single-circuit, 345,000-volt (345-kV) alternating-current (AC) electric transmission line across the U.S. international border in the vicinity of Baileyville, Maine.

The proposed transmission line would originate at the existing Orrington Substation, located in Orrington, Maine, and extend eastward about 85 mi (137 km) to the international border between the United States and Canada (Figure G-1). At the international border it would connect with a transmission line to be constructed, operated, and maintained by New Brunswick Power Corporation (NB Power).

G.1.1 Purpose of Consultation

The purpose of consultation with the National Oceanic and Atmospheric Administration’s National Marine Fisheries Service (NOAA Fisheries) is to provide an assessment of the effects of the proposed action on essential fish habitat (EFH) as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and to determine if granting the amendment to the Presidential permit may adversely affect EFH.

G.1.2 Background

In 1970, Maine Electric Power Company (MEPCO), a partnership of Central Maine Power Company, Maine Public Service Company, and BHE, placed in service a 345-kV transmission interconnection with NB Power. The BHE system now comprises about 600 mi (966 km) of transmission line corridors, including the MEPCO 106-mi (171-km) 345-kV transmission line that interconnects the Orrington Substation with NB Power’s system and that crosses the border near Orient, Maine.

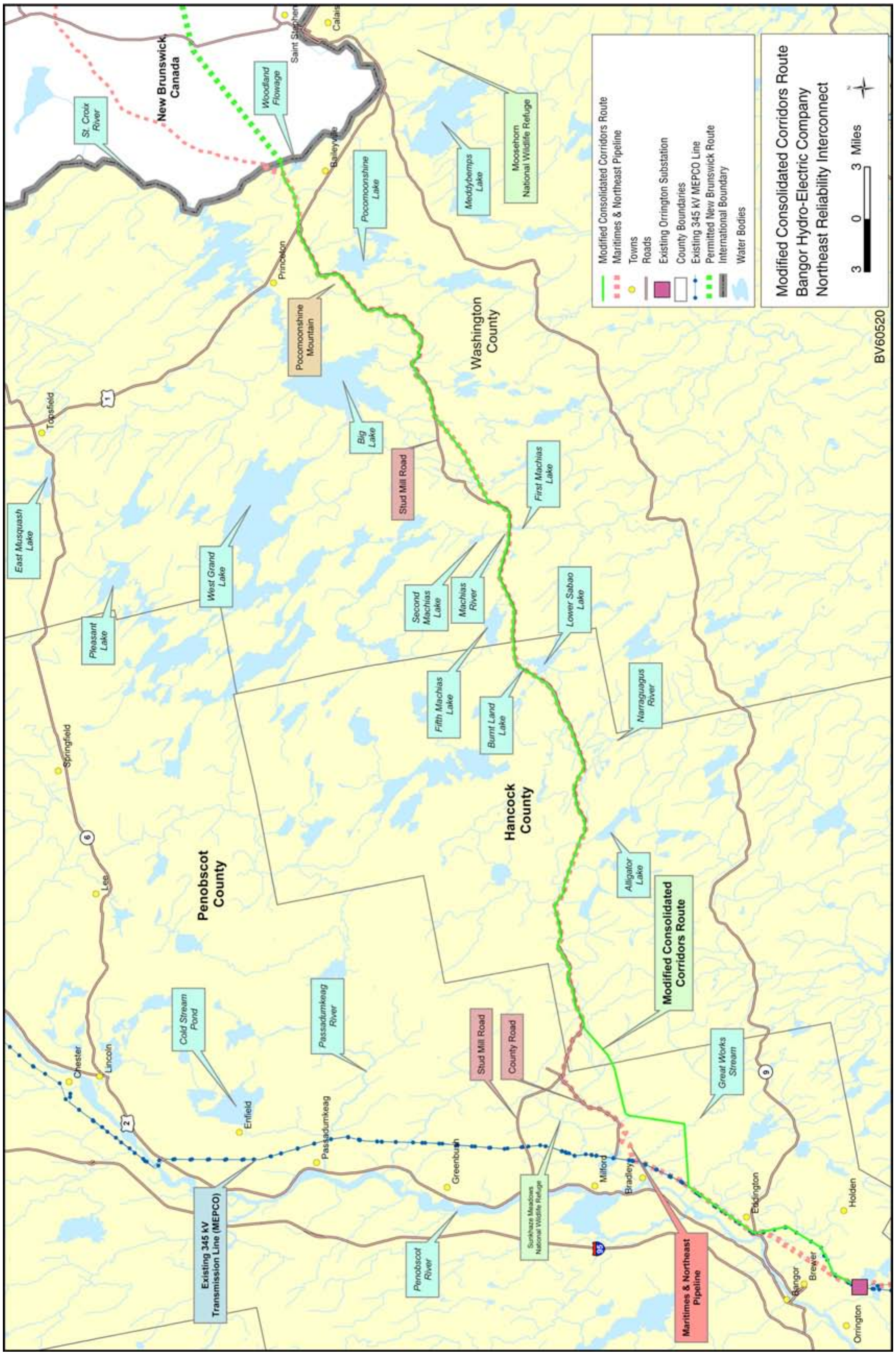

FIGURE G-1 Location of the Modified Consolidated Corridors Route (Source: Paquette 2005d)

On December 16, 1988, BHE applied to DOE for a Presidential permit to construct and operate a second 345-kV transmission line to New Brunswick. DOE published a notice of that application in the *Federal Register* on January 19, 1989 (Volume 54, page 2201 [54 FR 2201]) and a "Notice of Intent to Prepare an Environmental Impact Statement and to Conduct Public Scoping Meetings" in the *Federal Register* on May 22, 1989 (54 FR 22006). In August 1995, DOE published the *Final Environmental Impact Statement* [EIS] *for Construction and Operation of the Proposed Bangor Hydro-Electric Company's Second 345-kV Transmission Tie Line to New Brunswick* (DOE 1995). In a Record of Decision (ROD) signed on January 18, 1996 (62 FR 2244), DOE decided to grant Presidential Permit PP-89.

On January 22, 1996, DOE issued Presidential Permit PP-89 authorizing BHE to construct, operate, maintain, and connect a 345-kV electric transmission line that would extend eastward 83.8 mi (134.9 km) from the Orrington Substation to the U.S.-Canada border near Baileyville, Maine. The approved route was referred to as the Stud Mill Road Route. At the border, the proposed transmission line was to connect to complementary facilities to be built, operated, and owned by NB Power.

In addition to the Presidential permit, the BHE transmission line required regulatory approval from the State of Maine. BHE received its original State permit for the Stud Mill Road Route in 1992 and was granted State permit extensions in 1994 and 1996. In 1999, a natural gas transmission line was constructed by Maritimes & Northeast Pipeline, L.L.C. (M&N) in the same general vicinity of Stud Mill Road and BHE's approved electric transmission corridor. In 2001, BHE requested a third State permit extension. The Maine Board of Environmental Protection, Maine's primary environmental review entity, conducted a public hearing and indicated, in a draft order, a preference for BHE to use a route different from the Stud Mill Road Route, one that would be more closely consolidated with established linear corridors. This order was never finalized because BHE withdrew the request for an extension of the State permit.

On September 30, 2003, BHE applied to DOE to amend Presidential Permit PP-89 for a modification of the previously authorized transmission line route (Devine Tarbell & Associates, Inc. 2003).[1] DOE published a notice of that application in the *Federal Register* on October 29, 2003 (68 FR 61659). Therefore, the proposed transmission line project (now referred to as the Northeast Reliability Interconnect [NRI]) differs from the original project in the proposed route between the Orrington Substation and the international border crossing near Baileyville, Maine. In the United States, the applicant's preferred transmission line route (referred to as the Modified Consolidated Corridors Route) would be 85-mi (137-km) long (Figure G-1).

One of the regulatory requirements implemented since the original Presidential permit was granted is the preparation of an EFH assessment. This assessment is required by the MSA, as amended by the Sustainable Fisheries Act of 1996 and as implemented by Federal implementing regulations contained in the *Code of Federal Regulations*, Title 50, Part 600 (50 CFR Part 600).

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[1] The application to DOE to amend Presidential Permit PP-89 did not specify a preferred route; however, BHE subsequently advised DOE of its selection of the Modified Consolidated Corridors Route as the applicant's preferred route.

The MSA established eight regional fishery management councils to manage fish and shellfish resources in areas from 3 to 200 mi (5 to 322 km) offshore of the United States (also identified as the Exclusive Economic Zone, or EEZ). The 1996 Sustainable Fisheries Act amendment to the MSA required the fishery management councils to identify EFH within the EEZ for each resource species and for associated species (such as prey species) managed under Fishery Management Plans (FMPs) prepared by each of the councils. In addition, the councils may describe, identify, and protect habitats of managed species beyond the EEZ; however, such habitat may not be considered EFH for the purposes of Sections 303(a)(7) and 305(b) of the MSA. EFH regulations direct the councils and NOAA Fisheries to cooperate as closely as possible to identify actions that may adversely affect EFH. Further, Federal agencies are required to consult with NOAA Fisheries if their proposed actions may adversely affect designated EFH (50 CFR 600.920).

The New England Fishery Management Council (NEFMC) manages fishery resources in the EEZ of Maine and prepares FMPs that are used to manage those resources. The FMPs are submitted to NOAA Fisheries for approval. The NEFMC has developed nine fishery management plans to date, and all have been implemented by NOAA Fisheries. However, because of the project location, only the Atlantic salmon (*Salmo salar*) FMP is applicable to the EFH assessment for the NRI project.

G.1.3 Overview of Requirements and Terminology

The implementing regulations for EFH state that EFH assessments must include the following information [50 CFR 600.920(g)(2)]:

- Description of the proposed action,
- Analysis of the potential effects of the proposed action on EFH and managed species,
- The Federal agency's conclusions regarding effects of the action on EFH, and
- Proposed mitigation, if applicable.

Definitions that are applicable to EFH assessments include the following:

- *Essential Fish Habitat, or EFH*, means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (50 CFR 600.10). It includes freshwater, estuarine, or marine waters and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish, where appropriate (50 CFR 600.10). In this definition, the term "substrate" includes sediment, hard-bottom structures underlying the waters, and associated biological communities.

- *Necessary* means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. Spawning, breeding, feeding, and growth to maturity cover a species' full life cycle (50 CFR 600.10).

- *EFH consultation* means the process of satisfying the Federal agency consultation and response requirements of Sections 305(b)(2) and 305(b)(4)(B) and the EFH Conservation Recommendation requirement of Section 305(b)(4)(A) of the MSA (50 CFR 600.920).

- *EFH Conservation Recommendation* means a recommendation from NOAA Fisheries to a Federal or State agency pursuant to Section 305(b)(4)(A) of the MSA regarding measures that can be undertaken by that agency to conserve EFH (50 CFR 600.925). EFH Conservation Recommendations may be provided as part of an EFH consultation with a Federal agency or may be provided by NOAA Fisheries to any Federal or State agency whose action would adversely affect EFH (50 CFR 600.925).

- *Federal action* means any action that was authorized, funded, undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (50 CFR 600.910).

- *Adverse effect* means "any impact that reduces quality and/or quantity of EFH. Adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR 600.910).

- *Anadromous fishery* resource means an anadromous species (i.e., a species that spawns in freshwater and migrates to salt water for growth prior to returning to freshwater as adults to spawn) managed under an FMP (50 CFR 600.910).

In the event a Federal agency determines its proposed action may adversely affect designated EFH, the Federal action agency must consult with NOAA Fisheries as discussed above. Consultation is initiated upon submission of an EFH assessment to NOAA Fisheries, along with a written request for consultation. If NOAA Fisheries determines, on the basis of information presented in an EFH assessment, that the proposed action will not result in substantial adverse effects on EFH, or if NOAA Fisheries determines that no EFH Conservation Recommendations are needed, NOAA Fisheries will notify the Federal action agency of this determination, and the Federal action agency may conclude EFH consultation by using abbreviated consultation procedures (50 CFR 600.920(h)).

G.2 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is to grant the amendment to Presidential Permit PP-89 to allow BHE to construct, operate, maintain, and connect a new single-circuit 345-kV AC transmission line northeast from the substation at Orrington, Maine, to the U.S.-Canadian border near Baileyville, Maine. The applicant's preferred route for the project is known as the Modified Consolidated Corridors Route.

From the Orrington Substation, the Modified Consolidated Corridors Route would parallel the existing 345-kV MEPCO transmission line to Blackman Stream in the Township of Bradley. The Modified Consolidated Corridors Route would then proceed east-northeast, generally paralleling the M&N gas pipeline and Stud Mill Road to the international border at Baileyville, Maine. The Modified Consolidated Corridors Route would cross three counties and 17 municipalities or townships. The total distance of the Modified Consolidated Corridors Route would be about 85 mi (137 km). Figures B.1-1a through B.1-1n (Appendix B of the EIS) provide detailed maps of the Modified Consolidated Corridors Route.

G.2.1 Transmission Line Design Parameters

Table G-1 lists the basic design parameters for the proposed AC transmission line. The transmission line would have a single-circuit configuration and would consist of two overhead shield wires and three phases with two conductors per phase. The number of structures required and the average span between structures for the proposed route are listed in Table G-1. Self-supporting wood-pole H-frame structures would be used as the tangent support structure (i.e., structures used where the line is essentially along a straight path).

In addition to tangent structures, angle and dead-end structures would be required. These structures would consist of either three wood poles or three steel poles. The wood-pole angle and dead-end structures would use guy wires for support, while guy wires would not be required for the steel-pole structures. Dead-end structures would be required either (1) where the line makes an angle of 30 degrees or more, or (2) after 7 to 8 mi (11.3 to 12.9 km) of continuous suspension-type (tangent and light- and medium-angle) structures to prevent the potential cascading (domino-like collapse) of all of the support structures in the event of a major accident. A dead-end structure would also be used for the last structure before the crossing of the St. Croix River.

The conductors would be protected from lightning strikes by grounding systems installed at each structure (counterpoise ground wires) and by two aerial ground wires (shield wires). The transmission line would meet required horizontal and vertical wire security zones (BHE 2005). Transmission line height would reflect requirements for protecting the line from interference from tall trees. The amount of sag on a given conductor would be determined by a number of variables, including distance between towers, conductor weight, capacity, and temperature. Conductors also swing laterally. Side clearance would be determined on the basis of a worst possible condition (e.g., high temperature and high wind velocities). A minimum distance would

TABLE G-1 Design Parameters for the NRI

Parameter	Value (or Description)[a]			
	MCCR[b]	CCR	PPR	MSR
Length of line (U.S. portion)	85 mi	85 mi	84 mi	114 mi
Voltage	345 kV			
Capacity	500 MW[c]			
Conductors	Standard 1,192.5 kcml[d] 45/7 ACSR[e] code "bunting" (two per phase) with a diameter of 1.302 in., a weight of 1.344 lb/ft, and a rated breaking strength of 32,000 lb			
Shield wires	Standard 7 No. 8 Alumoweld[f]			
Guy wires (if, and where, required)	Standard 7 No. 5 Alumoweld, 0.546-in. diameter			
Insulators – conductor	5.75-in. × 10-in. porcelain ball and socket or polymer composite units			
Insulators – shield wire	Porcelain pin-clevis type			
Number of structures (total)	608	636	563	885
Tangent (wood)	491	472	499	821
Angle and dead-end (wood)	110	86	64	60
Angle and dead-end (steel)	7	78	0	4
Average span length (ft)	731	706	786	680
Minimum vertical clearance to vegetation (ft)	15			

[a] To convert miles to kilometers, multiply by 1.609; to convert inches to centimeters, multiply by 2.54; to convert pounds to kilograms, multiply by 0.454; to convert feet to meters, multiply by 0.305.

[b] CCR = Consolidated Corridors Route, MCCR = Modified Consolidated Corridors Route, MSR = MEPCO South Route, PPR = Previously Permitted Route.

[c] Maximum capacity of 1,000 MW during emergency conditions.

[d] kcml = 1,000 circular mil(s); the wire size for multiple-stranded conductors. A mil is one thousandth of an inch (0.001 in.) or approximately 0.0254 millimeters.

[e] ACSR = aluminum conductor, steel reinforced.

[f] One shield wire may be replaced with an optical ground wire if BHE were to install fiber-optic communication as part of the project.

be maintained between conductors of different phases or voltages to prevent “flashover,” a sudden surge of voltage causing an arc between conductors.

The transmission line design would meet the National Electric Safety Code specifications for heavy-loading conditions (e.g., radial ice of 0.5 in. [1.3 cm] thickness and 4 lb/ft^2 [19.5 kg/m^2] of wind pressure) and for extreme wind conditions (i.e., wind pressure of 23 lb/ft^2 [112 kg/m^2], equivalent to a wind speed of 90 mph [145 kph]). In addition, the transmission line structures would be designed to withstand heavy icing, as determined from a review of meteorological data (e.g., radial ice of 1.3 in. [3.3 cm] thickness) and longitudinal loading imbalance due to differential ice buildup and sheering.

G.2.2 Right-of-Way Configuration

The right-of-way (ROW) widths for various segments of the transmission line route would depend on the types of support structures and their proximity to existing utility ROWs or roads. The wood-pole H-frame structure and its horizontal configuration of phases (26-ft [7.9-m] separation from the outside phase to the centerline) were used as the standard pole design to establish the ROW widths. The ROW width for a new corridor segment would be 170 ft (51.8 m). This width is based on the spacing of the conductors (26 ft [7.9 m]) and the desired clearances of the outside conductor to the edge of the ROW (e.g., trees) to ensure a safe and reliable line.

Where the transmission line would be immediately adjacent to an existing cleared ROW or road, the required ROW width would be reduced on the side where the ROWs would be adjoining. Where the transmission line would parallel an existing transmission line, the ROW width would be based on the requirement of MEPCO to maintain a minimum of 100 ft (30.5 m) of separation between the centerlines of the two transmission lines. The distance to the edge of the opposite side of the ROW would be the required 85 ft (25.9 m), as previously described for a new corridor. Where the M&N gas pipeline would be located between the two transmission lines, the centerline separation between the transmission lines would be 125 ft (38 m).

Where the M&N gas pipeline and/or Stud Mill Road would be paralleled, the proposed transmission line width would average 155 ft (47.2 m). This dimension is based on the requisite half-width of 85 ft (25.9 m) from the transmission line centerline to the forested side of the ROW and 70 ft (21.3 m) between the centerline of the transmission line and the edge of the pipeline ROW or Stud Mill Road (BHE 2005). Table G-2 lists the length and percentage of the ROW for the preferred route that would be either a new ROW or adjacent to an existing ROW.

G.2.3 Transmission Line Construction

The construction of the NRI, including ROW clearing and installation of the structures, would be performed by independent contractors under close daily supervision by BHE engineering and environmental inspectors to ensure that the work is performed as specified by permit

TABLE G-2 Length (and percentage) of the NRI That Would Be New or Adjacent to Existing ROWs

ROW Configuration	Length (and percentage) and Total Area of ROW[a,b]
Part of ROW that is new, 170-ft wide (mi)	15 (18)
Part of ROW that is adjacent to pipeline or road, 155-ft wide (mi)	58 (68)
Part of ROW that is adjacent to MEPCO line, 100-ft wide (mi)	5 (6)
Part of ROW that is adjacent to the M&N gas pipeline and the MEPCO line, 125-ft wide (mi)	7 (8)
Total length of ROW along NRI line (mi)	85 (100)
Total ROW area (acres)	1,566

[a] Values rounded to nearest whole mile, acre, or percent.

[b] To convert miles to kilometers, multiply by 1.609; to convert feet to meters, multiply by 0.305; to convert acres to hectares, multiply by 0.405.

Sources: BHE (2005); Paquette (2005a).

conditions and construction specifications and that best management practices were followed to control erosion and other environmental impacts (BHE 2005). The general sequence of activities would be surveying; construction of access roads; ROW clearing; and support structure installation, framing, and string.

G.2.3.1 Surveying

The first operation to be completed would be a survey of the selected route. Surveying would establish the centerline and edges of the ROW. Generally, only a survey crew and small items of survey equipment would be required during this phase of the project. Establishing the centerline could require limited cutting of trees for line-of-sight staking, profiling, and distance measuring. Existing roads would be used to access the selected route. Most of the surveying work would proceed cross-country and on foot.

G.2.3.2 Construction of Access Roads

To the extent possible, existing roads would be used to gain access to project construction sites. Although no new access roads would be constructed, it might be necessary to upgrade or repair some existing access roads to allow vehicles and equipment for transmission line construction to pass. Improvements to existing access roads could include regrading of road surfaces, filling of ruts, and replacement of damaged culverts.

G.2.3.3 ROW Clearing

Trees would be cleared within the ROW only where necessary in order to facilitate (1) staking, access, assembly, and erection of structures; (2) installation of conductors and shield wires; (3) provision of adequate clearance for energized lines; and (4) maintenance. Low-growth woody vegetation would be left undisturbed where possible. The clearing program would be planned and implemented to encourage growth of low-growing native plants that would both stabilize the ROW against erosion and minimize the growth of trees (BHE 2005).

Because about 90% of the ROW is forested (including forested wetlands), vegetation clearing can be generally categorized as (1) clear-cutting or (2) several types of selective cutting. In addition, danger trees (trees that could pose a threat to the operation of the line if they grew or fell into the conductor security zone before the next cutting cycle) would be cleared outside of the designated ROW to provide the physical clearance necessary for proper, safe, and reliable operation and maintenance of the energized line. Generally, trees would be cut to 6 in. (15 cm) above the ground within cleared sections of the ROW. All logs would be removed from the ROW, while stumps would be removed only from support structure sites and some temporary access roads.

The applicant's normal cutting practice in forested areas would be used. First, the appropriate environmental safeguards would be established in the reach to be cleared, primarily by placing appropriate erosion control measures to the extent practicable (TRC 2005a). Trees would then be cut. Clear-cutting would involve the manual or mechanical cutting of all trees within the ROW. Low-growing shrubs and brush would be left to the extent practicable. All vegetation cut during initial clearing would be cleaned up and disposed of in accordance with the Maine Slash Law (BHE 2005). As part of land-clearing operations, much of the merchantable wood materials (e.g., sawlogs and pulpwood) would be salvaged. Tops of trees, cull material, and branches could be chipped on site and hauled to local power plants for use as fuel. Trees less than 2 in. (5 cm) in diameter might be left on site to deter the formation of new drainage channels in areas susceptible to erosion. In areas of low erosion potential, such trees might be windrowed (i.e., heaped up as if by the wind) or mulched. Following cutting and removal of the timber, the tree stumps of deciduous species might receive a basal application of herbicide applied by a low-pressure backpack applicator.

Riparian areas along streams and rivers would undergo selective cutting during construction of the transmission line. Generally, riparian buffer zones (areas of land along water bodies of sufficient width to lessen the entrance of pollutants such as those in eroded soil or to maintain adequate shading) would be at least 75 ft (23 m) wide on each side of perennial or intermittent streams. Within riparian buffer zones of Atlantic salmon streams of special concern, only the vegetation within the actual conductor security zone within or immediately adjacent to the ROW would be removed. All clearing would be conducted by hand or with feller bunchers.[2]

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2 A feller buncher is a large logging machine similar to a backhoe with an attachment that cuts trees in place of a shovel. It consists of a standard heavy-equipment base with a tree-grabbing device equipped with a saw or other device at the bottom that cuts the tree off at the base and places it on the stack of cut trees.

Because of the limited reach of feller bunchers, three access ways would be required within the 75-ft (23-m)-wide water body buffers. They would enable large trees across the ROW to be cut and removed with minimal additional ground disturbance and damage to remaining vegetation that would otherwise occur if the trees were hand cut and dragged out of the buffer with a cable (BHE 2005). One access way would be located at about the middle of the ROW and two would be located about halfway between the middle access way and an edge of the ROW. The access ways would be 10 to 12 ft (3 to 4 m) wide. The stream buffer access ways would differ from temporary access roads in that within the access ways, only trees that would prevent the harvesting equipment from performing its job or that would otherwise be seriously damaged by the equipment traveling along the access way would be removed. Also, access ways would not require grading or the addition of any surfacing materials such as gravel (BHE 2005). The access ways would not extend closer than 25 ft (7.6 m) from the edge of the stream banks. The two outer access ways would be restored at the completion of clearing activities, while the central access way would be restored at the end of all construction activities in the area. The outer access ways would be allowed to revert to their original state (within maintenance requirements), while the middle access way would be maintained as low-growing vegetation to allow small vehicle access during ROW vegetation maintenance (BHE 2005). No herbicides would be used within riparian buffer zones. Although the maximum height of vegetation beneath conductors would typically be maintained at 8 to 10 ft (2.4 to 3.1 m), in some portions of the ROW, the maintained vegetation heights in riparian buffer zones would typically be higher along streams of special concern for Atlantic salmon (Figure G-2). This practice would be facilitated by placing support structures as close to the outside edge (i.e., farthest edge from the stream bank) of the riparian buffer zone as possible, which would raise the height of the conductors in the riparian buffer zone.

G.2.3.4 Support Structure Installation, Framing, and Stringing

To accommodate installation of each support structure, a work area about 100 ft (30.5 m) wide and 170 ft (51.9 m) long, or 0.4 acre (0.16 ha), would be cleared of all woody growth except low shrubs and brush. All small woody plants would be removed from the immediate locations. The structural components would be placed in these work areas in preparation for construction and installation of the support structures. The support structures would be assembled on the ground and erected by a crane with a long boom.

H-frame wood-pole structures would be directly embedded. A foundation hole 9 to 12 ft (2.7 to 3.7 m) deep would be excavated at each pole location, and backfill would be placed around the pole after installation. Guy anchors for the wood-pole angle and dead-end structures would be steel anchor rods connected to a log buried in a trench about 7 ft (2.1 m) deep. Total construction time for a wood-pole support structure would be less than 1 day.

Steel-pole support structures could also be directly embedded in a similar manner except that some would be backfilled with concrete. They would also be installed on concrete bases, depending on site conditions. Foundation holes would be up to 30 ft (9 m) deep. Total construction time would be less than 4 days for a steel-pole support structure.

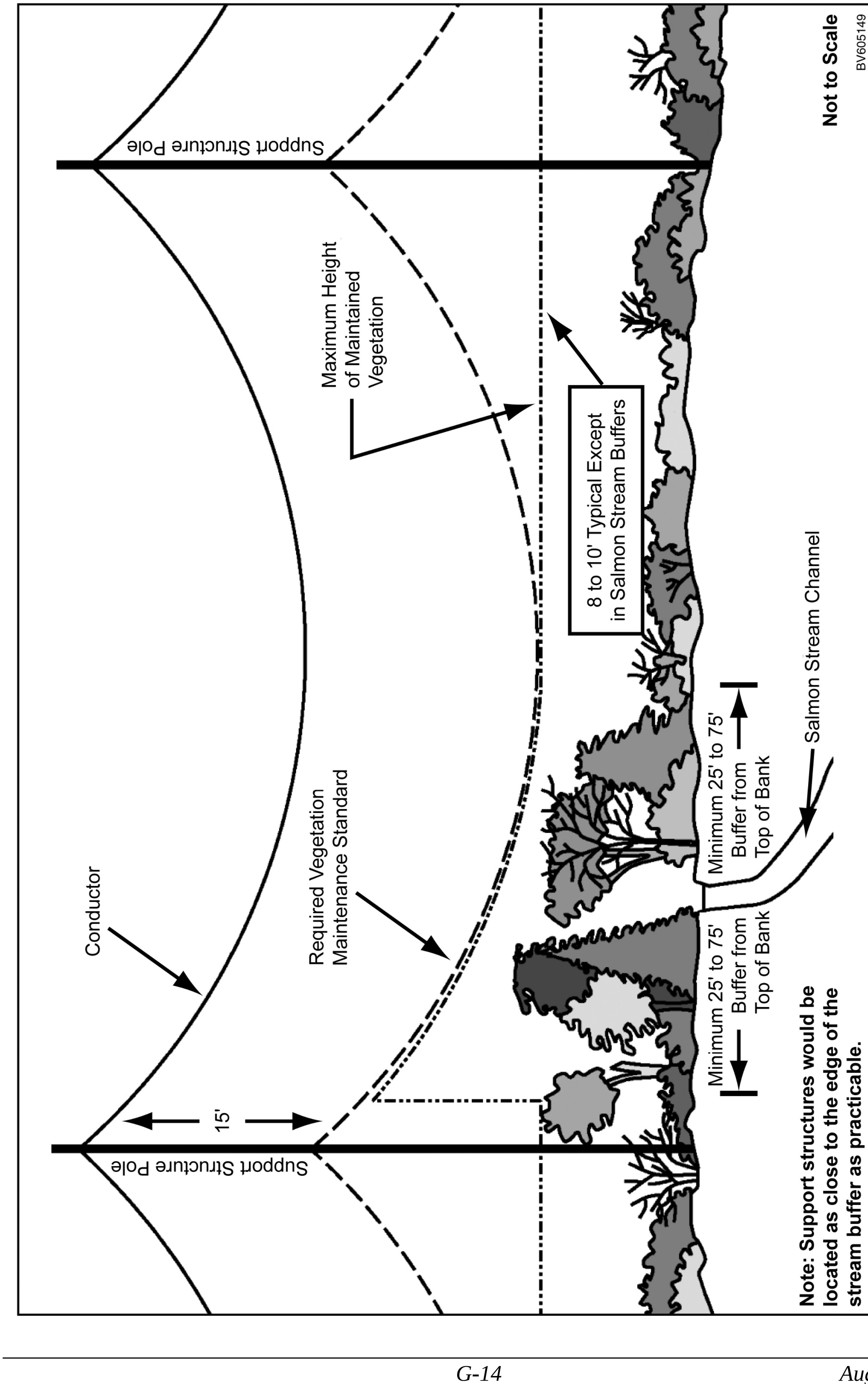

FIGURE G-2 Specifications for Vegetation Clearing and Maintenance along the Proposed ROW (Source: TRC 2005a)

After the support structures were in place, insulators would be installed and aerial shield (ground) wires and conductors strung. Conductors and shield wires would be pulled through the stringing blocks by tensioning equipment to keep them from coming in contact with the ground or other objects that could cause damage.

G.2.3.5 Installation of AC Mitigation for the M&N Gas Pipeline

AC mitigation would be required where the NRI would cross, parallel, or be located near unprotected portions of the M&N gas pipeline in order to protect worker and public safety, as well as to minimize potential impacts on the integrity of the pipeline facilities (see Section 2.3.5 of this EIS). The AC mitigation technique under consideration for the M&N gas pipeline includes the installation of a parallel zinc ribbon buried about 1.5 ft (0.5 m) deep above the existing unprotected pipeline. The zinc ribbon would be either plowed in place or installed into an excavated trench that would be backfilled after the ribbon was installed. The ribbon would be attached to the pipeline at regular intervals (e.g., every 1,000 to 5,000 ft [305 to 1,524 m]). It is expected that the zinc ribbon would be installed along the length of the pipeline that would be co-located with the NRI. However, the ribbon would be discontinuous and would not be installed where the existing pipeline crosses streams (Paquette 2005c).

G.2.4 Post-Construction Maintenance Practices

Post-construction maintenance would consist primarily of line inspection and vegetation management. The growth rates of vegetation can vary as a result of differences in species, soil, climate, and site conditions. Therefore, periodic ROW inspections would be required to determine if there were areas where trees might approach minimum clearances before the next scheduled vegetation maintenance period. Management of vegetation along the ROW would consist of the felling of trees adjacent to the ROW that posed a risk to the transmission line and control of vegetation within the ROW. An integrated approach for managing vegetation within the ROW would be used to encourage low-growing plant species and discourage tall-growing vegetation (TRC 2005b).

Maintenance clearing would be conducted on a 3- to 4-year cycle and would consist of some of the same types of activities as generally during the initial clearing. Post-construction vegetation management would include the following: (1) areas of selective clearing (e.g., riparian buffer zones, wetlands, areas near rare and uncommon natural areas, and areas containing special status species or other wildlife species of concern); (2) areas of side clearing along the edge of the ROW (e.g., removal of danger trees); and (3) areas of clear-cutting within the ROW. ROW maintenance within riparian buffer zones would be limited to cutting only those trees that could present a safety hazard to the transmission line before the next cutting cycle (3 to 4 years). Buffer zones are protected areas of land along water bodies or wetlands that have sufficient width to reduce the movement of eroded soil or to maintain adequate shading. Only the upper portion of evergreen trees that infringed into the wire security zone would be cut. For hardwoods, only those trees likely to reach the bottom limit of the wire security zone before the next cutting cycle would be removed. Cutting along the edge of the ROW would involve the removal of encroaching branches from each side of the ROW (i.e., side trimming). The areas within the ROW would be maintained by hand and mechanical cutting, combined with optional foliar, basal, and cut-stump application of herbicides. No herbicide applications would occur within any riparian vegetation buffers. Only herbicides registered for use by the U.S. Environmental Protection Agency (EPA), approved for use by the State of Maine, and determined by BHE's experience (or the experience of others) to be effective for basal and cut-stump applications would be used to maintain the ROW.

G.2.5 Schedule

Construction would begin with ROW clearing upon issuance of all required Federal, State, and local permits. It is expected that ROW clearing would begin in the winter when the ground is frozen in order to minimize ground disturbance impacts, especially within wetlands. Site-specific mitigation and restoration activities would be carried out during all phases of construction. Plans call for the project to be completed and the line to be energized within 12 to 18 months of commencement of construction.

G.3 ESSENTIAL FISH HABITAT WITHIN THE PROJECT AREA

The Sustainable Fisheries Act amended the MSA by requiring identification and descriptions of EFH in FMPs (see *United States Code,* Title 16, Section 1801 [16 USC § 1801]). For this EFH assessment, the only FMP applicable to the area that would be traversed by the ROW for the proposed action is that for the Atlantic salmon. The NEFMC has defined EFH for the Atlantic salmon as all waters currently or historically accessible to Atlantic salmon within the watersheds of specific streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut that meet the following conditions for specific life stages.

- *Eggs.* EFH for eggs consists of bottom habitats with a gravel or cobble riffle above or below a pool of rivers that currently support Atlantic salmon. Generally, the water in the pits that Atlantic salmon construct for egg-laying (i.e., redds) is below 50°F (10°C) and consists of clean, well-oxygenated freshwater. Atlantic salmon eggs are most frequently present in redds between October and April. EFH locations for Atlantic salmon eggs are shown in Figure G-3.

- *Larvae.* Bottom habitats with a gravel or cobble riffle above or below a pool of rivers and streams that currently support Atlantic salmon can support the larval life stage. Generally, Atlantic salmon larvae, alevins, and fry occur in locations with clean, well-oxygenated freshwater and water temperatures below 50°F (10°C). Atlantic salmon alevins and fry are most frequently observed between March and June. EFH locations for Atlantic salmon larvae are shown in Figure G-3.

FIGURE G-3 Essential Fish Habitat for Atlantic Salmon Eggs and Larvae (Source: NEFMC 1998)

- *Juveniles.* Bottom habitats of shallow gravel/cobble riffles interspersed with deeper riffles and pools in specific rivers and estuaries can support the juvenile life stage. Generally, Atlantic salmon parr are found in areas with clean, well-oxygenated freshwater; water temperatures below 77°F (25°C), water depths of 4 to 24 in. (10 to 61 cm); and water flows of 12 to 36 in./s (30 to 92 cm/s). As they grow, parr transform into smolts. Atlantic salmon smolts require downstream access to make their way to the ocean. Upon entering the sea, "post-smolts" become pelagic and range from Long Island

Sound north to the Labrador Sea. EFH locations for juvenile Atlantic Salmon are shown in Figure G-4.

- *Adults.* For adult Atlantic salmon returning to spawn, EFH includes habitats with resting and holding pools in rivers and estuaries that currently support Atlantic salmon. Figure G-5 shows the EFH locations for adult Atlantic salmon. Returning Atlantic salmon require access to their natal streams and access to the spawning grounds. Generally, conditions where returning Atlantic salmon adults are found migrating to the spawning grounds include water temperatures below 73°F (23°C) and dissolved oxygen levels above 5 parts per million (ppm). Oceanic adult Atlantic salmon are primarily pelagic and range from the waters of the continental shelf off southern New England north throughout the Gulf of Maine.

- *Spawning adults.* EFH for spawning adults includes bottom habitats with a gravel or cobble riffle above or below a pool of specific rivers that currently support or historically supported Atlantic salmon spawning (Figure G-5). Generally, conditions where spawning Atlantic salmon adults are found include water temperatures below 50°F (10°C); water depths of 12 to 24 in. (30 to 61 cm); water flows around 24 in./s (61 cm/s); and clean, well-oxygenated freshwater. Spawning Atlantic salmon adults are most frequently observed during October and November.

In summary, designated Atlantic salmon EFH includes all appropriate aquatic habitats in the watersheds of the 26 rivers identified in Figures G-3 to G-5, including all tributaries, to the extent that they are currently or were historically accessible for salmon migration. Atlantic salmon EFH specifically excludes areas in these watersheds that are located upstream of long-standing, naturally impassable barriers (e.g., natural waterfalls in existence for at least several hundred years). EFH for Atlantic salmon also includes a number of bays and estuaries.

EFH regulations also direct the Fishery Management Councils to consider a second, more limited habitat designation for each species in addition to EFH. Habitat areas of particular concern (HAPCs) are described in the regulations as subsets of EFH that are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPCs are not afforded any additional regulatory protection under the MSA. However, Federal projects with potential adverse impacts on HAPCs are more carefully scrutinized during the consultation process. In addition to identifying general EFH for Atlantic salmon, the NEFMC also identified HAPC for adult Atlantic salmon to consist of 11 coastal drainages in Maine that support unique and important populations of Atlantic salmon. These water bodies are the St. Croix, Denny's, East Machias, Machias, Pleasant, Narraguagus, Penobscot, Ducktrap, Sheepscot, and Kennebec Rivers and Tunk Stream.

The affected area for the NRI project along the proposed route does not include any habitats in or near bays, estuaries, or offshore areas. Accordingly, the project is not expected to have any adverse effects on EFH or EFH species in such areas. Surveys conducted along the

FIGURE G-4 Essential Fish Habitat for Atlantic Salmon Juveniles (Source: NEFMC 1998)

proposed route (Paquette 2005b) identified 117 crossings of freshwater streams and ponds (Table G-3), although some of these water bodies are unlikely to provide suitable habitat conditions for Atlantic salmon. Thus, the proposed route would cross streams in 6 of the 26 watersheds that have been identified as containing EFH for Atlantic salmon, including the watersheds for the St. Croix, East Machias, Machias, Narraguagus, Union, and Penobscot Rivers. Except for Union River, all of these rivers have also been designated as HAPCs for Atlantic salmon. For this reason, the area in which EFH could potentially be affected by direct and indirect effects of the proposed action is limited to these six watersheds.

FIGURE G-5 Essential Fish Habitat for Atlantic Salmon Adults (Source: NEFMC 1998)

G.4 LIFE HISTORY CHARACTERISTICS OF ATLANTIC SALMON

G.4.1 Distribution and Abundance

The range for Atlantic salmon along the western Atlantic Ocean extends from the Ungava Bay, Hudson and Davis Straits, and southern Greenland southward. In addition to adult salmon that occur in marine waters, Atlantic salmon are also found in most major river systems from the Labrador coast to the Connecticut River (where they have been reintroduced). Sixteen rivers in

TABLE G-3 Water Bodies Crossed by the Modified Consolidated Corridors Route of the Proposed NRI Project

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Penobscot River Watershed (38 crossings)					
5,415	Tributary to Felts Brook	3	1.0	Sand or silt	Large extensive cattail marsh community; portions flow through forest with sparse understory.
5,898	Tributary to Felts Brook	3	1.0	Sand or silt	Large extensive cattail marsh community; portions flow through forest with sparse understory.
6,314	Tributary to Felts Brook	3	1.0	Sand or silt	Large extensive cattail marsh community; portions flow through forest with sparse understory.
6,939	Tributary to Felts Brook	10	1.0	Sand or silt	Large extensive cattail marsh community; portions flow through forest with sparse understory.
6,978	Tributary to Felts Brook	6	1.0	Sand or silt	Large extensive cattail marsh community; portions flow through forest with sparse understory.
7,667	Tributary to Felts Brook	3	1.0	Sand or silt	Large extensive cattail marsh community; portions flow through forest with sparse understory.
8,652	Tributary to Felts Brook	12	1.5	Marine sediment	Slow-moving, meandering channel is surrounded by floodplain grass/sedge community with *Nuphar variegatum* and *Potamogeton* sp.
10,394	Tributary to Felts Brook	4	3.0	Mineral, muck, stony	Narrow channel meanders through forest with thick understory of grasses and ferns and few shrubs.
12,440	Tributary to Felts Brook	15	1.0	Mineral, eroded sediment to glacial till	Channel flows through dense shrubs with thick understory of grasses and ferns.
14,673	Felts Brook	15	3.0	Marine sediment	Highly meandering channel with floodplain that is about 300 ft wide on west side; there are sedges and grasses on floodplain, and then dense shrubs surround the floodplain: *Nuphar* sp., *Nuphaea* sp., and *Potamogeton* sp.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Penobscot River Watershed (38 crossings) (Cont.)					
15,051	Tributary to Felts Brook	5	2.0	Gravel/cobble	Highly meandering channel with floodplain that is about 300 ft wide on west side; there is emergent vegetation on floodplain, and dense shrubs surround the floodplain: *Nuphar* sp., *Nuphaea* sp., *Potamogeton* sp.
18,047	Tributary to Felts Brook	3	3.0	NA[c]	Channel substrate composed of gravel; some portions flow through a forested area surrounded by thick grasses; other portions flow through dense grasses in open field.
18,284	Tributary to Felts Brook	3	3.0	NA	Channel substrate composed of gravel; some portions flow through a forested area surrounded by thick grasses; other portions flow through dense grasses in open field.
24,080	Eaton Brook	30	5.0	Muck/silt	Channel is surrounded by dense grasses in open field.
35,553	Tributary to Eaton Brook	10	NA	NA	NA
39,971	Tributary to Penobscot	5	Dry	Alluvium, stony	Intermittent channel flows under Hill Street through forest with sparse understory.
52,099	Meadow Brook	30	3.0	Muck	Channel is surrounded by dense grasses: *Calamagrostis canadensis*, *Scirpus atrovirens*, *J. effuses*, *Pontegaria* sp., and *Potamogeton* sp., with numerous snags.
53,650	Tributary to Meadow Brook	3	2.0	Mineral	Meandering channel flows through forest.
56,220	Tributary to Meadow Brook	30	10.0	Muck	NA
63,754	Blackman Stream	50	NA	NA	Palustrine scrub-shrub on streambanks: *Cephalanthus occidentalis*, *Ilex verticillata*, *vaccinium corymbosum*, and *Spiraea tomentosa*.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Penobscot River Watershed (38 crossings) (Cont.)					
67,800	Beaver pond	90	2.0	Silt-muck	Impoundment created by beavers; gradually transitions into emergent plants: grasses, *Calamagrostis canadensis*, and *Scirpus cyperinus*.
73,534	Boynton Brook	40	4.0	Silt-muck	Channel is surrounded by sedge/low shrub marsh with numerous snags and submergent aquatic vegetation (SAV).
74,022	Tributary to Boynton Brook	4	0.5	Silt-muck	Intermittent channel flows through alder thicket with sparse grassy understory.
75,078	Tributary to Boynton Brook	5	0.5	Silt-muck	Channel flows through alder thicket with sparse grassy understory.
81,441	Great Works Stream	100	NA	NA	Gradually transitions to emergent vegetation: *Calamagrostis Canadensis* and *Scirpus cyperinus*.
93,825	Unnamed tributary	2	0.2-0.3	Peat-muck	Intermittent small channel flows through cedar forest with sparse understory.
98,613	Baker Brook	25	NA	NA	Rock and boulder substrate located in coniferous forest with sparse understory.
107,101	Little Birch Stream	8	0.7	Silt-muck	Channel is surrounded by dense alder thicket.
109,290	Tributary to Little Birch Stream	30	1.0	90% silt-muck, 10% boulder	Channel is surrounded by dense alder thicket.
109,560	Tributary to Little Birch	10	1.0	90% silt-muck, 10% boulder	Channel is surrounded by dense alder thicket.
116,426	Titcomb Brook	2	0.7	Silt-muck	Channel flows through forest, with some portions surrounded by alder thicket, and other portions flooded over banks.
117,705	Tributary to Birch Stream	8	1.0	70% silt-muck, 20% gravel/cobble, 10% boulder	Channel flows through forest and alder thickets, with patches of grasses throughout.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Penobscot River Watershed (38 crossings) (Cont.)					
119,623	Tributary to Birch Stream	5	0.7	NA	Channel is flooded; inundated area consists of dense alder thicket and thick grasses.
126,046	Tributary to Birch Stream	2	0.4	Silt-muck	Intermittent channel is flooded; inundated area consists of dense alder thicket and thick grasses.
129,265	Birch Stream	12	3.0	50% sand, 50% gravel/cobble	Channel is flooded; inundated area consists of thick grasses surrounded by dense alder thicket.
135,118	Sunkhaze Stream	35	NA	NA	Channel is flooded; inundated area consists of grasses and low shrubs.
136,695	Wiley Brook	10	2.0	Boulder	Channel is surrounded by alder thicket and dense grasses and sedges.
141,829	Tributary to Indian Brook	7	0.5	Gravel/cobble	Channel is surrounded by alder thicket and dense grasses and sedges.
Union River Watershed (12 crossings)					
151,167	Dead Stream	30	<10.0	Sand	Channel is immediately surrounded by marsh containing snags: *Nuphar* sp.
157,789	Beaver pond	NA			
159,777	Hinckley Brook	20	NA	Silt-muck	Channel is not well defined in part and has grassy vegetated bottom.
159,971	Beaver pond	NA			
173,851	Main Stream	50	4.0	Gravel/cobble	Grassy edges of stream are surrounded by alders, balsam fir, and some mature maples.
177,988	Tributary to Alligator Stream	<1	0.3	70% sand, 20% gravel/cobble, 10% silt-muck	Narrow intermittent channel flows through forest of striped maple, red maple, and hemlock with sparse undergrowth; flows from culvert under Stud Mill Road.
181,987	Tributary to Alligator Stream	2	0.4	60% bedrock, 40% boulder	Narrow intermittent channel flows through forest of balsam fir, paper birch, and hemlock with sparse undergrowth; flows from culvert under Stud Mill Road.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Union River Watershed (12 crossings) (Cont.)					
182,464	Tributary to Alligator Stream	<1	0.3	40% gravel/cobble, 20% silt-muck, 20% sand, 20% boulder	Narrow intermittent channel flows in forest of hemlock, cedar, and ash with sparse undergrowth.
183,446	Unnamed tributary	<1	0.2	Sand	Narrow intermittent channel flows in forest of yellow birch and red maple with sparse undergrowth.
183,661	Tributary to Alligator Stream	6	0.8	40% sand, 40% boulder, 20% bedrock	Channel is surrounded by alders and young red maples.
184,960	Tributary to Alligator Stream	<1	0.2	50% sand, 50% gravel/cobble	Shallow intermittent channel flows through forest of striped maple and hemlock with sparse understory.
191,489	Alligator Stream	7	0.7	50% gravel/cobble, 50% boulder	Broad channel is surrounded by green ash, alders, and maples, with ferns, sedges, and poison ivy growing in understory and in shallow water.
Narraguagus River Watershed (9 crossings)					
196,308	Tributary to W. Br. Narraguagus River	2	0.5	40% boulder, 20% bedrock, 20% sand, 20% gravel/cobble	Narrow channel is surrounded by shrubs and sparse undergrowth.
196,974	Tributary to W. Br. Narraguagus River	3	0.5	50% peat-muck, 50% silt-muck	Meandering channel flows under dense shrub cover consisting of alders and maples; dense sedges in some portions, but understory is usually sparse.
199,913	Tributary to W. Br. Narraguagus River	4	0.5	80% gravel/cobble, 20% boulder	Meandering channel flows through forest of cedar, paper birch, winterberry, and steeplebush.
204,796	Tributary to W. Br. Narraguagus River	4	0.5	70% gravel/cobble, 30% sand	Meandering stream flows under dense shrub cover consisting of alders and maples; dense sedges in some portions, but understory is usually sparse.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Narraguagus River Watershed (9 crossings) (Cont.)					
207,372	Tributary to W. Br. Narraguagus River	5	NA	NA	Channel is flooded; inundated area consists of grasses and low shrubs with numerous snags.
216,804	Tributary to W. Br. Narraguagus River	1	0.3	Peat-muck	Channel flows through forested section into alder shrub thicket and disperses through marsh understory.
221,880	Narraguagus River	50	4.0	Sand, silt-muck	Channel flows through low shrubs with SAV and few snags throughout.
225,162	Allen Brook	15	1.0	Sand, gravel/cobble	Channel is surrounded by sedge/low shrub marsh with numerous snags and SAV.
229,947	Tributary to Narraguagus River	8	2.0	50% sand, 50% gravel/cobble	Channel is surrounded by alder thicket with few snags.
Machias River Watershed (32 crossings)					
237,834	Thompson Brook	8	3.0	50% peat-muck, 25% silt-muck, 25% boulder	Channel is flooded as a result of beavers; is surrounded by sedge/low shrub marsh with numerous snags and SAV.
238,483	Tributary to Thompson Brook	8	1.0	70% gravel/cobble, 30% sand	Channel flows through sedge/low shrub marsh with numerous snags and logs that cross channel.
240,635	Tributary to Thompson Brook	3	0.7	40% peat-muck, 30% gravel/cobble, 30% boulder	Somewhat stagnant channel flows through alder thicket with sedge/low shrub understory and numerous snags.
241,270	Tributary to Thompson Brook	2	<0.5	Silt-muck	Intermittent channel; areas near culvert contain water; most areas have standing water, but some have flowing water; however, no defined channel was observed.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Machias River Watershed (32 crossings) (Cont.)					
245,138	Tributary to Lower Sabao Lake	8	0.5	40% boulder, 30% gravel/cobble, 20% sand, 10% silt-muck	Channel is braided throughout and runs underground in places and between boulders.
247,383	Tributary to Lower Sabao Lake	75	3.0	90% silt-muck, 10% gravel/cobble	Channel is flooded as a result of beavers and is surrounded by sedge/low shrub marsh with numerous snags.
251,199	Tributary to Lower Sabao Lake	2.5	0.7	Sand	Channel is flooded as a result of beavers and is surrounded by sedge/low shrub marsh with numerous snags.
252,686	Connector between Lower Sabao Lake and Burnt Land Lake	30	0.7	Sand, gravel/cobble	Channel ponds before culvert and is surrounded by dense grasses/sedges and low shrubs.
254,757	Tributary to Lower Sabao Lake	3	0.5	Sand, gravel/cobble	Channel is surrounded by alder thicket with dense grass understory.
256,157	Tributary to Lower Sabao Lake	1	0.3	Silt-muck	Narrow intermittent channel flows through forest of cedar and maple; is sometimes braided and/or flows underground.
257,324	Tributary to Lower Sabao Lake	5	1.0	Gravel/cobble	Channel is flooded as a result of beavers and is surrounded by sedge/low shrub marsh and alder thicket.
261,275	Tributary to Lower Sabao Lake	3	0.5	75% sand, 25% silt-muck	Intermittent channel flows out of culvert in sheet flow; flows through forest of balsam fir and cedar with sparse understory.
267,124	Tributary to Fifth Machias Lake	6	0.5	40% sand, 40% gravel/cobble, 20% silt-muck	Channel flows through shrub wetland with sparse understory of ferns and mosses.
271,806	Tributary to Fifth Machias Lake	3	0.5	Sand	Channel flows through forest of cedar, balsam fir, and maple; portions flow through dense shrubs.
273,801	Lake Brook	3	0.7	NA	Channel flows through cedar forest with thick shrub understory.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Machias River Watershed (32 crossings) (Cont.)					
275,056	Tributary to Lake Brook	4	0.3	Sand, silt-muck	Intermittent channel flows through cedar forest with thick shrub understory.
277,015	Tributary to Fifth Machias Lake	5	0.5	40% sand, 30% gravel/cobble, 20% silt-muck, 10% boulder	Channel flows through open forest, with ferns and mosses overhanging the banks.
277,305	Tributary to Fifth Machias Lake	5	0.5	40% sand, 30% gravel/cobble, 20% silt-muck, 10% boulder	Channel flows through open forest, with ferns and mosses overhanging the banks.
280,106	Tributary to Fifth Machias Lake	3	0.3	Silt-muck	Small intermittent channel flows through forest to culvert.
281,525	Tributary to Fifth Machias Lake	2	0.5	Sand	Channel flows through dense alder thicket within cedar forest.
281,556	Tributary to Fifth Machias Lake	2	0.5	90% sand, 10% silt-muck	Channel flows through dense alder thicket within cedar forest.
281,838	Tributary to Fifth Machias Lake	2	0.5	90% sand, 10% silt-muck	Channel flows through dense alder thicket within cedar forest.
290,950	Tributary to Fletcher Brook	2	0.5	90% silt-muck, 10% sand	Intermittent channel flows through forest.
291,272	Tributary to Fletcher Brook	4	0.5	60% silt-muck, 40% sand	Channel flows through dense alder thicket within cedar forest.
291,302	Tributary to Fletcher Brook	4	0.7	Sand	Channel flows through dense alder thicket within cedar forest.
291,907	Tributary to Fletcher Brook	2	0.7	80% silt-muck, 10% sand, 10% gravel/cobble	Channel flows through forest with thick fern understory, many fallen trees, and overhanging vegetation.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
Machias River Watershed (32 crossings) (Cont.)					
292,631	Tributary to Fletcher Brook	3	6.0	Silt-muck	Channel flows through forest with thick fern understory, many fallen trees, and overhanging vegetation.
296,321	Machias River	72	NA	NA	Wide channel flows through palustrine scrub-shrub growing close to edge, with overhanging branches.
298,978	Tributary to First Machias Lake	2	0.3	50% sand, 50% gravel/cobble	Intermittent channel flows in dense shrubs.
304,252	Dead Stream	1	0.3	Silt-muck	Channel flows from culvert and disperses into wetland.
307,524	Tributary to Dead Stream	4	0.7	40% silt-muck, 30% sand, 30% gravel/cobble	Channel flows through forested and shrubby areas; moss-covered logs cross stream.
311,339	Lanpher Brook	2	0.3	Sand	Channel flows through cedar forest with ferns and overhanging shrubs; lots of woody debris in stream.
St. Croix River Watershed (8 crossings)					
321,754	Tributary to Little Musquash Stream	4	0.3	50% sand, 50% gravel/cobble	Channel flows through cedar forest with ferns and overhanging shrubs; lots of woody debris in stream.
331,487	Tributary to Heath Brook Branch	4	0.4	40% peat-muck, 30% sand, 30% gravel/cobble	Channel flows through cedar forest with sparse understory; lots of woody debris in stream.
336,585	Tributary to Big Wallamatogue Stream	2	0.3	80% peat-muck, 20% boulder	Channel flows through mature cedar forest with sparse understory; woody debris in stream.
338,429	Big Wallamatogue Stream	6	NA	NA	Channel is flooded as a result of beavers and is surrounded by alder shrub marsh with numerous snags.
344,791	Little Wallamatogue Stream	3	0.5	Silt-muck, sand	Channel flows through cedar forest with sparse understory.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
St. Croix River Watershed (8 crossings) (Cont.)					
350,719	Tributary to Clifford Lake	10	1.0	Muck	Channel flows through cedar forest with sparse understory.
355,146	Clifford Stream	20	1.0	Alluvial to sand	Channel flows through palustrine scrub-shrub and emergent marsh.
360,324	Scott Brook	10	1.0	Gravel/cobble	Channel flows through cedar forest with dense understory; woody debris in stream.
East Machias River Watershed (14 crossings)					
366,527	Tributary to Huntley Brook	6	1.5	Gravel/cobble	Channel flows through forest with shrubby understory; woody debris in and around channel.
370,297	Huntley Brook	20	4.0	Gravel/cobble	Channel flows through forest and shrubs; dense grasses and sedges in and around channel.
383,168	Joe Brook	10	2.0	Boulder, bedrock	Channel flows through cedar forest.
385,800	Tributary to Joe Brook	10	1.0	Mineral/cobble	Intermittent channel flows through dense shrubs with thick understory of grasses, ferns, and herbs.
393,116	Tributary to Allen	30	1.5	Muck	Channel flows through dense shrubs with thick understory of grasses and herbs growing in stream, with few snags.
394,508	Allen Stream	50	0.8	Muck	Channel is surrounded by sedge/low shrub marsh, with numerous snags and SAV.
399,376	Tributary to Pocomoonshine Lake	4	0.0	Gravel/loam	Intermittent channel flows through forest with sparse understory.
400,910	Tributary to Pocomoonshine Lake	4	0.2	Cobble, stony	Channel flows through forest with dense shrub understory.
407,667	Lewys Brook	10	1.0	Gravel/cobble	Wide channel flows through forest with overhanging shrubs and branches.

TABLE G-3 (Cont.)

Approximate Station[a,b] (ft along route)	Water Body	Average Width (ft)	Average Depth (ft)	Channel Substrate	Description of Water Body and Adjacent Vegetation
East Machias River Watershed (14 crossings) (Cont.)					
410,363	Rocky Brook	25	1.0	Muck, gravel/cobble	Channel flows through forest with overhanging shrubs, branches, and herbaceous plants.
416,668	Dog Brook	15	6.0	Muck	Channel is overflowing banks; is surrounded by sedge/low shrub marsh with numerous snags and SAV; stream is impounded by culvert level in road.
419,594	Tributary to Dog Brook	15	5.0	Muck	Flat water meanders within dense shrubs and herbs; various herbs within channel.
421,586	Tributary to Dog Brook	6	0.5	Gravel/cobble	Intermittent channel flows through forest with shrubby understory.
422,654	Unnamed Tributary	3	0.5	Mineral, stony	Intermittent channel flows through forest with shrubby understory.
St. Croix River Watershed (4 crossings)					
433,948	Tributary to Grand Falls Flowage	2	0.5	Peat-muck	Meandering channel flows through forest with sparse understory.
441,364	Sprague Meadow Brook	30	3.0	Silt-muck	Wide channel flows through shrub marsh.
442,972	Tributary to St. Croix River	3	0.2	Silt-muck	Narrow intermittent channel flows through dense shrubs.
445,214	St Croix River/Woodland Flowage	500	NA	NA	South side of channel flows along forested land with trees, with overhanging branches near edges.

[a] Approximate station distance from the Orrington Substation.

[b] To convert feet to meters, multiply by 0.305.

[c] NA = not available.

Source: Paquette (2005b).

Maine are considered to be Atlantic salmon rivers and once supported abundant populations of wild Atlantic salmon. However, the population levels have been declining since at least the middle of the 19th century and remain critically low in all of the rivers that maintain natural spawning runs (Maine Atlantic Salmon Commission 2004). The low numbers led to listing of Atlantic salmon in eight Maine Rivers (Cove Brook, Denny's, Ducktrap, East Machias, Machias, Narraguagus, Pleasant, and Sheepscot) as an endangered distinct population segment under the Federal Endangered Species Act by the U.S. Fish and Wildlife Service and the NOAA Fisheries on November 17, 2000 (50 CFR 17.224).

Table G-4 presents the estimated amounts of salmon habitat available in the river watersheds that would be crossed by the proposed route. Of these six watersheds, the Penobscot River has the largest drainage area and also receives the largest number of returning adult Atlantic salmon. However, even the numbers of adults returning to the Penobscot are very low; only 1,114 returning adults were counted in 2003, following a low return of only 535 adults in 2000 (Maine Atlantic Salmon Commission 2004).

G.4.2 Life History

Atlantic salmon are anadromous (i.e., they spawn in freshwater and migrate to salt water for growth before returning to freshwater as adults to spawn) and have a complex life history that extends from spawning and a juvenile period in freshwater rivers to extensive feeding migrations in the Atlantic Ocean. While the description of the life cycle for Atlantic salmon is somewhat simplified in this document, a more detailed description of Atlantic salmon in Maine has been

TABLE G-4 Availability of Atlantic Salmon Habitat in Watersheds Crossed by the Proposed Transmission Line Route[a]

River	Total U.S. River Length (mi)	River Drainage Area (mi^2)	Estimated Area of Salmon Habitat[b] (acres)
Saint Croix	31	2,500	7
East Machias	37	251	74
Machias	61	460	152
Narraguagus	48	232	149
Union	62	500	207
Penobscot	166	8,570	3,089

[a] To convert miles to kilometers, multiply by 1.609; to convert square miles to square kilometers, multiply by 1.609; to convert acres to hectares, multiply by 0.405.

[b] Salmon habitat identified as riffles and runs.

Source: National Research Council (2004).

compiled by the National Research Council (2004). Most Atlantic salmon of U.S. origin spend two winters in the ocean before returning to their natal rivers to spawn. Atlantic salmon that return to freshwater after spending 1 year at sea are on average about 22 in. (57 cm) long, while fish that spend 2 or 3 years at sea return at larger average sizes of about 30 or 35 in. (75 or 88 cm), respectively (Collette and Klein-MacPhee 2002).

In Maine, adult Atlantic salmon typically return to freshwater rivers from the Atlantic Ocean between June and October. These fish typically spawn between mid-October and mid-November (National Research Council 2004). Atlantic salmon require free-flowing rivers of moderate gradient that remain cool in the summer and contain clean gravel substrates for spawning. Females excavate gravel from the stream bed to construct nesting depressions (i.e., redds), which are typically located just upstream or downstream of pools at water depths of 12 to 24 in. (30 to 61 cm). A typical female lays about 7,000 eggs, which are fertilized by a male as they are laid. Although some adults survive to spawn in subsequent years, most die following spawning.

The eggs overwinter in the gravel and hatch the following spring, usually in March and April (National Research Council 2004). The eggs hatch best at water temperatures below 50°F (10°C) and require clean gravel and well-oxygenated water for survival. Newly hatched fry remain in the gravel and use energy reserves in their yolk sacs to continue development; as the yolk sacs become depleted, the fry emerge from the gravel and begin feeding on plankton and small invertebrates (generally in mid-May).

After emerging from redds, the fry disperse and develop markings along their sides; at this point, the young Atlantic salmon are considered to have entered the parr stage. Parr are generally found in well-oxygenated riffle areas with gravel and cobble substrate, moderate water depth (4 to 24 in. [10 to 61 cm]), and moderate to fast water flow (1 to 3 ft/s [30 to 92 cm/s]).

The parr stage of Atlantic salmon lasts for 1 to 3 years in Maine rivers (National Research Council 2004). During this period, the parr reach a length of about 4 in. (10 cm). After reaching this size, parr undergo a developmental change during the spring and become known as smolts. As smolts, the young Atlantic salmon begin migrating toward the ocean. During their downstream migration, smolts begin schooling and develop the salinity tolerance they need when they enter the ocean. For migration to occur, smolts require access to the ocean.

Once in the ocean, young salmon grow rapidly, feeding primarily on such fish as Atlantic herring, alewife, rainbow smelt, capelin, mummichogs, sand lances, flat fish, and small Atlantic mackerel (Collette and Klein-MacPhee 2002). The young salmon eventually migrate toward their major feeding grounds in the North Atlantic near Greenland and Iceland. After spending 1 or 2 years at sea, adult salmon migrate back to the stream in which they were originally produced. It is generally thought that salmon use a magnetic or sun compass to find their way to the coast of their natal river, although this is not known for certain. They then use olfactory cues learned as smolts to find the river and tributary of their origin.

G.5 EFFECTS OF THE PROPOSED ACTION ON DESIGNATED EFH

A variety of factors, including stream hydrology, water temperatures, pH, dissolved oxygen, streambed characteristics, availability of food, competition, predation, pollution, and recreational and commercial fishing, interact to affect the survival of the various life stages of salmon in rivers and streams (Maine Atlantic Salmon Task Force 1997; National Research Council 2004).

As identified in previous sections, Atlantic salmon require cool, well-oxygenated streams with coarse gravel beds and suitable water depths and velocities. Habitat becomes unavailable to Atlantic salmon if dams (both human-built dams and beaver dams), road culverts, pollutants, elevated water temperatures, or reduced stream flows block or delay the access of adults to spawning areas. Withdrawal of water for irrigation and other purposes may affect the availability and quality of habitat, especially when water is withdrawn during low flow periods. Erosion of sediment due to construction activities, roads, land development, agricultural fields, and poor forestry practices can fill interstitial spaces in gravel streambeds, thereby reducing survival of salmon eggs and larvae and reducing the production of aquatic invertebrates that serve as food (Waters 1995).

Excessive nutrients can increase aquatic plant growth, changing the ecological characteristics of streams. Direct discharges of organic material from hatcheries, sewage treatment plants, and manufacturing or processing plants can reduce dissolved oxygen concentrations. Removal of streamside vegetation that provides shade can result in an increase in summer water temperatures, which, in turn, can reduce oxygen solubility (Maine Atlantic Salmon Task Force 1997). Maintaining riparian buffer zones adjacent to streams that support Atlantic salmon helps protect critical habitat by regulating temperature, regulating stream flow (attenuating peak flows and maintaining base flows), protecting water quality, and providing organic input that serves as a food source for aquatic macroinvertebrates (Kleinschmidt Associates 1999).

Recreational or commercial harvesting can kill individual fish and, depending on the level of mortality, affect population viability (Maine Atlantic Salmon Task Force 1997; National Research Council 2004). While the harvest of anadromous Atlantic salmon is currently prohibited in Maine (MDIFW 2005), some illegal harvest of adult salmon may occur as adult fish return to spawn (Maine Atlantic Salmon Task Force 1997). Commercial fishing operations may incidentally catch salmon as they harvest other species, and, even in cases when fish are released, the stress and injury that result from handling may result in increased mortality (Maine Atlantic Salmon Task Force 1997). Development of additional human access to rivers and streams that are used by adult salmon could lead to increased angling and increased mortality.

A wide range of chemicals, including petroleum products, pesticides, and metals, are toxic to fish, including Atlantic salmon. Solid waste management practices, long-range atmospheric transport, direct discharges, and accidental spills are some of the potential sources of contaminants. Atlantic salmon mortality can occur when concentrations exceed lethal thresholds; lower concentrations can affect growth, physiology, and behavior (Maine Atlantic Salmon Task Force 1997). Various environmental stresses, combined with normal exposure to diseases or parasites, can increase the likelihood of disease. In some cases, fish hatcheries and aquaculture operations in an Atlantic salmon watershed can increase the risk of a wild population's exposure to pathogens and parasites (National Research Council 2004).

The small sizes of the remaining Atlantic salmon populations may increase the probability of random changes in gene frequencies (genetic drift), which can affect the ability of populations to respond to environmental changes. The probability of inbreeding, which can also affect gene frequencies in populations, also increases as population sizes decline (National Research Council 2004).

Atlantic salmon are also threatened by changes in the species composition and population sizes of competitors and predators. For example, brown trout (*Salmo trutto*) and smallmouth bass (*Micropterus dolomieu*), which have been introduced to rivers and streams in Maine to provide recreational fishing opportunities, are potential competitors of Atlantic salmon and may prey on parr and smolts in some areas (National Research Council 2004).

The following sections evaluate potential adverse effects on EFH by considering whether specific activities related to the proposed action would negatively affect Atlantic salmon individuals or EFH through alterations in stream conditions (e.g., hydrology, water temperatures, pH, dissolved oxygen), streambed characteristics, availability of food, levels of competition and predation, pollution (including introduction of sediment), and fishing pressure.

G.5.1 Transmission Line Construction

Overall, it is anticipated that there would be no effects on EFH for Atlantic salmon from the proposed action. The potential effects of various construction-related activities on EFH for Atlantic salmon are discussed in the following sections.

G.5.1.1 Surveying

It is expected that the surveying work required to establish the centerline and edges of the ROW would have no adverse effect on EFH for Atlantic salmon. As identified in Section G.2.3.1, this work would be conducted by survey crews using small items of survey equipment and would proceed primarily cross-country and on foot. The presence of the work crews is unlikely to affect EFH or individual salmon. While a limited number of trees and branches would be cut to establish a line of sight for the surveying measurements, such clearing would have no appreciable effect on shading or other stream conditions at any of the proposed stream crossing locations.

G.5.1.2 Construction of Access Roads

As identified in Section G.2.3.2, construction of the transmission line would not require construction of any new access roads. However, some repairs and upgrades to existing access roads might be necessary. All access road modifications and upgrades would be performed under supervision to ensure that all construction specifications and Maine Department of Environmental Protection (MDEP) permit conditions were met. Compliance would include the implementation of various mitigation measures to control erosion and runoff of sediment and to ensure that fuel and other chemicals were not released into water bodies (BHE 2005). In addition, a sufficient riparian vegetation buffer zone would be maintained along all waterways to ensure that shading characteristics were not affected (BHE 2005). Consequently, it is anticipated that there would be no impacts on EFH for Atlantic salmon from the upgrade or repair of access roads under the proposed action. The upgrade and repair of access roads could potentially include the replacement of damaged culverts. This could improve potential fish passage.

G.5.1.3 ROW Clearing

Perhaps the greatest potential for effects on EFH for Atlantic salmon would occur during clearing of the proposed ROW. As identified in Section G.2.3.3, all clearing work would be supervised to ensure that MDEP permit conditions and construction specifications were met (BHE 2005). A minimum riparian vegetation buffer of 75 ft (23 m) would be maintained along most streams and rivers, although the stream buffer zones would be 25 ft (76 m) wide where the NRI would parallel the existing MEPCO 345-kV transmission line. Some trees in the buffer zones would need to be selectively trimmed to maintain adequate clearance for the transmission line (a minimum of 15 ft [4.6 m] of clearance is required beneath the transmission line). As described in Section G.2.3.3, vegetation beneath the conductors in riparian buffer zones would be allowed to reach heights of at least 8 to 10 ft (2.4 to 3.1 m) before trimming would be required. The maintained vegetation heights in riparian buffer zones would typically be higher along streams of special concern for Atlantic salmon. Given the relatively small width of most of the streams crossed by the proposed route (more than 75% of the water bodies crossed by the proposed route are less than 15 ft [4.5 m] wide [Table G-3]), it is anticipated that shade characteristics for stream channels with potential Atlantic salmon habitat would be maintained. Runoff of sediment would continue to be controlled by the filtration capabilities of the riparian zone.

Although herbicides could be used to control vegetation along some portions of the proposed ROW, no herbicides would be used within riparian buffer zones. This practice would greatly reduce the potential for herbicides to reach streams containing Atlantic salmon, where these contaminants could otherwise affect salmon and aquatic organisms.

Under the proposed action, approximately 80 acres (32 ha) of forested land located within 150 ft (46 m) of the proposed ROW could be cleared and converted to scrub-shrub habitat. Clearing of forested habitat along the ROW could slightly increase the access of recreational anglers to particular streams. Although the inland fishery for anadromous Atlantic salmon in the State of Maine is currently closed (MDIFW 2005), this increased access could result in additional mortality to Atlantic salmon in some streams and rivers as a result of incidental hooking and handling. Because the increased access provided by the ROW would be small, and because only a small proportion of the streams crossed would be likely to support anadromous Atlantic salmon, the effect of the increased access on mortality would be negligible. In addition, it is anticipated that regulations that have been developed by the MDIFW and that are periodically changed to accommodate changes in fishing pressures would be sufficient to offset potential effects of the ROW on angler access.

Overall, it is anticipated that route clearing activities for the proposed ROW would not adversely affect EFH for Atlantic salmon.

G.5.1.4 Support Structure Installation, Framing, and Stringing

Although up to 0.4 acre (0.16 ha) of land would be cleared for the installation of each support structure, support structures would be set back more than 75 ft (23 m) from streams and rivers that support coldwater fisheries. As a consequence, no heavy machinery or clearing would occur within the prescribed riparian vegetation buffer zone. Adhering to accepted management practices for controlling sediment transport to streams (e.g., installation of silt fences), coupled with the filtration capacity of the riparian buffer areas, would effectively preclude the transport of excessive sediment to streams that contain EFH for Atlantic salmon. In addition, the time required to install an individual support structure would be about 1 day. Therefore, the potential for effects to occur to Atlantic salmon in a particular stream would be limited to a relatively short period. It is anticipated that the installation of support structures would not adversely affect EFH for Atlantic salmon.

G.5.1.5 Installation of AC Mitigation for the M&N Gas Pipeline

The zinc ribbon for AC mitigation for the existing M&N gas pipeline would not be installed in stream crossings. Erosion control would be used at any riparian areas that might require AC mitigation. As a consequence, there would be no adverse effects from the planned AC mitigation activities on EFH for Atlantic salmon.

G.5.2 Post-Construction Maintenance Practices

Post-construction activities within the ROW would consist primarily of line inspection, line repairs, and vegetation management. Line inspections would mostly be aerial and on-the-ground inspections. Repairs would be made by using techniques similar to those employed during construction of the line and currently used on other ROWs. It is anticipated that the existing access roads would be sufficient to gain access to the ROW for both inspections and repairs. No adverse impacts on EFH for Atlantic salmon are anticipated from these activities.

As identified in Section G.2.4, vegetation management would be conducted through a combination of tree removal and vegetation control. Although foliar, basal, and cut-stump applications of herbicides could be used to control vegetation within some portions of the ROW, no herbicides would be applied within the riparian vegetation buffer zones. This practice would greatly reduce the potential for inadvertent release of herbicides to streams that might contain EFH for Atlantic salmon.

When applied outside the riparian vegetation buffer zones, the herbicides that are typically used for management of vegetation within the ROW (Accord®, Arsenal®, and Krenite®) would be relatively unlikely to affect stream habitats. The active ingredient in Accord is glyphosphate. Glyphosphate itself is of relatively low toxicity to fish. Some glyphosphate formulations are approved for aquatic use, although the surfactants used in some formulations can be toxic to fish. In addition, glyphosphate has an extremely high ability to bind to soil particles, thus reducing the mobility of the herbicide in the environment. It has an average half-life of 2 months in soil (Tu et al. 2001).

Imazapyr is the active ingredient in the herbicide Arsenal. Water contamination by imazapyr is generally not of concern because of its rapid photodegradation (average half-life of 2 days) in the presence of sunlight. This herbicide can also be strongly adsorbed to soils, which would restrict mobility in the environment. Imazapyr also has a low rate of bioaccumulation in aquatic organisms and is considered practically nontoxic to fish on the basis of standardized EPA protocols (Tu et al. 2001).

The active ingredient in Krenite is fosamine ammonium. Although highly water soluble, fosamine ammonium binds readily with some soils and does not leach readily through soil. The typical half-life in the environment ranges from 1 to 2 weeks. This herbicide is considered only slightly toxic to fish and aquatic invertebrates, and there is no evidence that fosamine ammonium bioaccumulates in fish (Tu et al. 2001).

Given the types of activities that would occur in the ROW following construction of the transmission line, the avoidance of major activities or herbicide applications within the riparian vegetation buffer zones, and the low probability of the selected herbicides affecting aquatic organisms, it is anticipated that post-construction maintenance activities would not adversely affect EFH for Atlantic salmon.

G.5.3 Overall Effects on EFH

On the basis of the evaluations presented above, it is anticipated that there would be no significant alterations in stream conditions, streambed characteristics, availability of food, levels of competition and predation, pollution, or fishing pressure as a result of the proposed action. Consequently, DOE concludes that there would be no adverse effects on EFH or HAPCs for Atlantic salmon from the proposed action.

G.6 CONSERVATION AND PROPOSED MITIGATION MEASURES

Because there would be no adverse effects on EFH or HAPCs from the proposed action, no conservation or mitigation measures are identified beyond those described in Section 2.4 for the construction and maintenance of the NRI. However, it should be noted that certain aspects of the proposed action would serve to protect stream habitats and, as a consequence, protect EFH for Atlantic salmon from being adversely impacted by the project. These aspects are largely related to the maintenance of suitable riparian vegetation buffer zones along streams and rivers and the avoidance of activities within those buffer zones that could harm aquatic habitats and aquatic organisms. These practices, in turn, would protect streams within the project area that could potentially support Atlantic salmon eggs, larvae, juveniles, and adults from impacts associated with sedimentation, changes in shading (and, therefore, temperature changes), contamination by herbicides, and related indirect effects.

G.7 CONCLUSION

The proposed action would not adversely affect EFH for Atlantic salmon in the six watersheds crossed by the proposed NRI along the Modified Consolidated Corridors Route.

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